Monthly variations of some physical and chemical properties for Al-Garraf River one of the main Tigris branches at Al-Haay City

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التغيرات الشهرية لبعض الصفات الفيزئية والكيميائية لمياه نهر الغراف في مدينة الحي

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المستخلص

درست التغيرات الشهرية في الخصائص الفيزيائية والكيميائية للمياه لتقييم نوعية مياه نهر الغراف بيئياً للمدة من تشرين الاول 2012 إلى نيسان 2013 .حيث يقع نهر الغراف في الجزء الجنوبي الشرقي من العراق و تحيط فيه مساحات شاسعة وخصبة من الأراضي الزراعية. تم اختيارثلاثة محطات للدراسة ، تقع المحطة الأولى على بعد 2 كم من مدينة الحي لتكون محطة السيطرة. وتقع المحطة الثانية على بعد 2 كم من المحطة الأولى حيث تمثل منطقة الدراسة .أما المحطة الثالثة فتقع على بعد 4 كم من المحطة الثانية بعد اجتياز النهر لمدينة الحي. تم أخذ العينات شهرياً وبواقع نموذجين لكل شهر.الغرض قياس قيم و تراكيز مؤشرات الماء وتراوحت التراكيز الشهرية كالاتي: درجة حرارة الهواء (16 الى 32) م^0 و الماء (11 الى 26) م^0 و الاس الهيدروجيني (7.05 الى 8.35) والاوكسجين الذائب (7.04 الى 10.38) ملغم/ لتر والمتطلب البايلوجي للاوكسجين (0.90 الى7.01) ملغم/ لتر و عكورة المياه (31.0الى177.0) وحدة عكورة والمواد الصلبة الذائبة (550.78 الى 1108) ملغم/ لتر والمواد الصلبة العالقة (38 الى 636.5) ملغم/ لتر والتوصيلية الكهربائية (827 الى1558) مايكروسيمنز والملوحة (0.54 الى 0.99) جزء بالألف والعسرة الكلية (275 الى 500) ملغم/ لتر والكلورايد (89.02الى 184.6) ملغم/ لتر والنترات(5.7الى15.76) ملغم/ لتر والفوسفات (0.15الى 0.5) ملغم/ لتر .

Abstract

Monthly variations in Physio-chemical parameters of Al-Garraf, one of the main tributaries of the Tigris river were investigated from October 2012 to April 2013. The study location situated in the south-eastern sector of Iraq and surrounded by wide and fertile agricultural lands. Three stations were selected to. The former is located at 2 km of AL-Haay City as control. The second is situated at distance 2 km away from the former represented study area and the latter station is located at 4 km apart from the second one. Collecting samples monthly, two samples were taken each month .

In the present study fourteen physical and chemical parameters were analyzed based on the importance of these parameters. These Fourteen parameters are ranged as following: air temperature (16 to 32) ºC, water temperature (11 to 26) ºC, pH (7.05to 8.35), E.C. (827 to1558) µS/cm, salinity (0.54 to 0.99) ppt, DO (7.04 to 10.38) mg/L , BOD (0.90 to 7.01) mg/L ,turbidity (31.0 to 177.0) NTU, TDS (550.78 to 1108) mg/L , TSS (38 to 636.5) mg/L

, T.H (275 to 500) mg/L , Cl^- (89 to 184.6) mg/L, NO_3 (5.7 to 15.76) mg/L and PO_4 (0.15 to 0.5) mg/L.

Introduction

Rivers have always been the most important fresh water resources, and most developmental activities are still dependent upon them. Rivers play a major role in assimilating or carrying industrial and municipal waste water, manure discharge and runoff which are responsible for water river pollution[1] [2]. The degree of pollution is generally assessed by studying physical and chemical characteristics of the water bodies[3]

Iraqi inland waters witness tremendous impacts through discharges of manufacturers, agricultural and domestic sewage [4] [5]. Quite few studies were performed on Tigris River [6] [7] [8], but no work had considered Al-Garaf canal in Al-Haay City. The present study has taken in consideration the investigation of abiotic conditions in this vital habitat on monthly basis .

2. Material and Methods

2.1. Study area

Al- Garraf River is one of two branches of the Tigris River at Kutt City, 225 km south of Baghdad City (Fig. 1). After branching from the Tigris, the Garaff flows southeast toward Al-Haay City (study area) within Wasit Province, 220 km southwest of Baghdad City. The river is 230 km in length with a variable depth of 17.4 m at its branching point from the Tigris to 10.0 m at its junction with the Euphrates River at the marsh area near Thiqar Province .

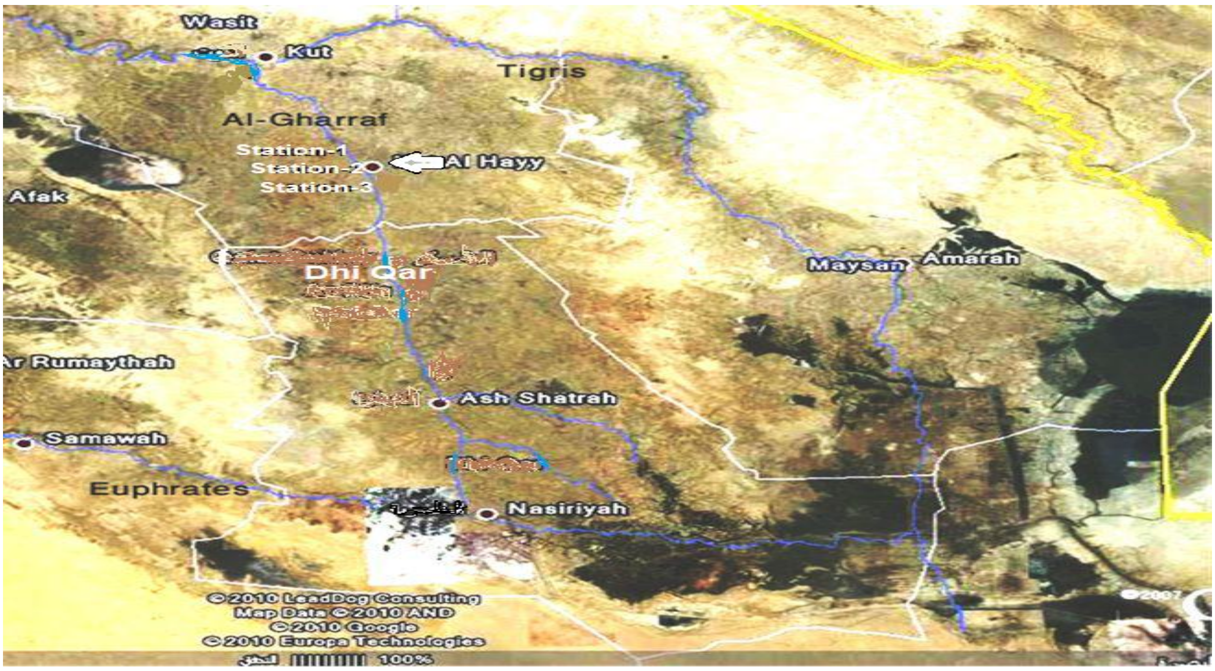


Figure (1) : The map of sampling location in the study area

2.2. Sampling

Samples for physical and chemical variables were performed from three sites during period extended from the October 2012 to April 2013. Water samples were collected for physiochemical analysis using pre-washed polyethylene bottle by water sample twice before filling.

The studied physico-chemical parameters include water temperature (by using precise mercury thermometer), hydrogen ion concentration (by using pH-meter), electrical conductivity (by using EC-meter), turbidity level (by using turbidity-meter), dissolved oxygen (titrimetric methods), biological oxygen demand (Winkler methods), nitrate, reactive phosphate (by using spectrophotometric methods), total hardness and chloride (by using titrimetric methods), were measured according to APHA[9] [10].

3. Results

Figure (2) and Table (1), showed monthly changes in air temperature for the three selected stations. Values ranged between 16ºC in station-1 during January (2013) to 32º C in station-2 during April (2013).

Figure (3) and Table (1), however, indicated monthly variations in water temperature. The lowest value was 11ºC in station-2 during January (2013) and the highest 26ºC in station-2 during April (2013).

Figure (4) and Table (1), showed monthly changes in pH. The lowest (7.05) was encountered in October (2012) from station-2 and the highest (8.35) was recorded in November (2012), but values in general were slightly alkaline direction.

Figure (5) and Table (1), Showed monthly changes in values of Electrical conductivity. The lowest (827 µs/cm) was measured from station-3 in March (2013) and the highest (1558 µs/cm) was observed in October (2012) from station-2.

Figure (6) and Table (1), showed monthly changes in values of water salinity. The lowest (0.54 ppt) was observed in station-3 during March (2013) and the highest (0.99 ppt) measured from station-2 in October (2012). Figure (7) and Table (1), Shows monthly changes in values of Turbidity. The lowest (31.0 NTU) was observed in station-3 in December (2012) and the highest (177.0 NTU) was observed in Junuary (2013) from station-2.

Figure (8) and Table (1), revealed monthly variations in dissolved oxygen in selected stations Values declined during October (2012). The lowest (7.04 mg/L) was in October (2012) from station-2 and the highest (10.38 mg/L) was, in general, in January (2013) from station-1.

Figure (9) and Table (1), showed monthly variations in values of biological oxygen demands (BOD). The lowest (0.90 mg/L) was recorded in March (2013) from station-1 and the highest (7.01 mg/L) was in November (2012) from station-2.

Figure (10) and Table (1), showed monthly changes in total dissolved solid. The lowest (550.78 mg/L) was encountered in March (2013) from station-3 and the highest (1108 mg/L) was recorded in October (2012) from station-2.

Figure (11) and Table (1), showed monthly variations in total suspended solid. The lowest (38 mg/L) was observed in December (2012) from station-1 and the highest (636.5 mg/L) was observed in January (2013) from station-2.

Figure (12) and Table (1), revealed monthly variations in values of total hardness in the selected localities. Highest value (500 mg/L) was in November (2012) and encountered from station-2. The lowest (275 mg/L), however, was in January (2013) from station-1.Figure (13) and Table (1), showed monthly changes in values of Chloride. The lowest (89.02 mg/L) was measured from station-1 in March (2013) and the highest (184.6 mg/L) was observed in November (2012) from station-2. Figure (14) and Table (1), revealed monthly variations in Nitrate. The lowest (5.7 mg/L) was in April (2013) from station-1 and the highest (15.76 mg/L) was observed in November (2012) from station-2. Figure (15) and Table (1), Showed monthly changes in values of Reactive phosphate. The lowest (0.15 mg/L) was observed in October (2012) from station-1 and the highest (0.5 mg/L) was observed in December (2012) from station-2.

Table (1): Monthly variation for Al-Gharaf River through period study 2012 – 2013

Time	**Station**	**Air T. C °**	**Water T. C °**	**PH**	**E.C ms/cm**	**Sali. mg/l**	**DO mg/l**	**DOB5 mg/l**
October 2012	**Station1**	30	24	7.38	1335	0.87	8.22	1.89
	Station2	30	26	7.05	1558	1.0	7.04	7.0
	Station3	32	25	7.34	1339	0.87	7.61	4.01
Noveber 2012	**Station1**	25	20	7.7	910	0.59	9.62	1.45
	Station2	25	17	7.06	1150	0.75	8.44	7.01
	Station3	24	20	8.35	915	0.59	8.25	3.14
December 2012	**Station1**	23	19	8.1	1228	0.79	8.01	2.08
	Station2	22	17	8.1	1387	0.90	8.25	6.39
	Station3	23	17.5	8.2	1311	0.86	8.59	4.12
January 2013	**Station1**	16	11.5	8.09	1075	0.69	10.38	2.0
	Station2	16	11	7.98	1078	0.70	8.36	5.5
	Station3	16	12.5	7.77	1062.5	0.69	9.57	2.5
March	**Station1**	28	24	7.8	855	0.56	8.0	0.90

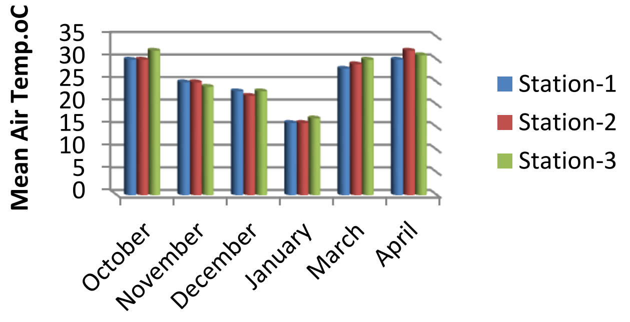
2013	**Station2**	29	23	7.5	888	0.58	7.5	4.5
	Station3	30	23	7.8	827	0.54	8.1	2.1
April 2013	**Station1**	30	25	7.8	1018	0.65	8.1	1.9
	Station2	32	26	7.3	1029	0.66	7.2	5.2
	Station3	31	24	7.2	1014	0.65	7.9	2.9

Appendix -1

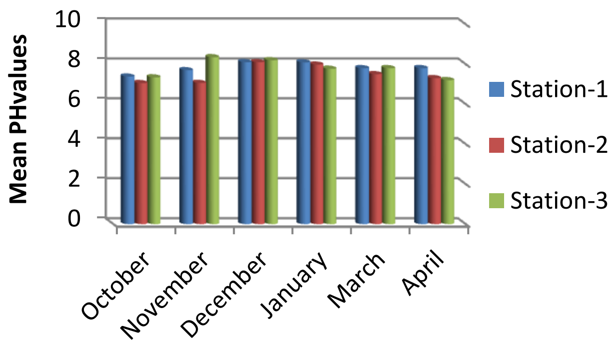
Time	**Station**	**Turb. NTU**	**TSS mg/l**	**TDS mg/l**	**T.H mg/l**	**Cl^- mg/l**	**$NO3^=$ mg/l**	**$PO4^{-3}$ mg/l**
October 2012	**Station1**	78	838	946	430	99.4	15.09	0.15
	Station2	121	1090	1108	460	134.9	15.00	0.57
	Station3	74	938	928	437.5	113.6	15.69	0.31
Noveber 2012	**Station1**	33.0	828	606.1	360	118.9	6.75	0.17
	Station2	56.0	1132	765.9	500	184.6	15.76	0.19
	Station3	53.0	834	609.2	360	124.3	7.21	0.23
December 2012	**Station1**	33.0	38	817.9	407	133.0	6.6	0.3
	Station2	42.0	74	923.8	438	152.0	7.0	0.5
	Station3	31.0	85	873.2	415	139.0	7.5	0.4
January 2013	**Station1**	161.0	976	715.9	275	134.9	10.12	0.19
	Station2	177.0	986	717.9	335	138.5	12.45	0.23
	Station3	163.5	948	707.7	360	120.7	9.62	0.2
March 2013	**Station1**	35	65	569.43	310.4	89.02	6.1	0.32
	Station2	67	96	591.40	388	103.07	7.0	0.43
	Station3	43	85	550.78	329.8	91.36	6.0	0.38
April 2013	**Station1**	33	56	677.99	314	89	5.7	0.33
	Station2	52	86	685.32	412	109	6.2	0.45
	Station3	37	87	675.32	392	95	5.7	0.38

Table (2): Comparison between some water quality parameters of Al-Gharraf River with the Iraqi and international standards.

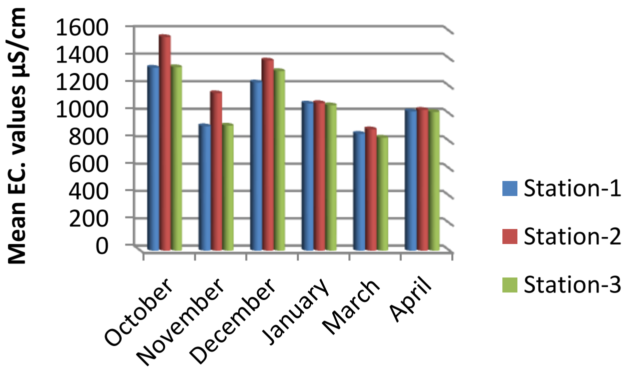
Parameter	WHO standards for drinking water in 2004	EEC 464/76 stander for surface water quality (Tebbutt, 1998)	Iraqi standards for water quality in 1998	Present Study Mean
pH	6.5- 8.5	6.5- 8.5	6.5- 8.5	7.7
TDS mg/L	500-1500	500-1500	1000	829.39
Turbidity NTU	0-50	0-25	25	104
DO mg/L	> 5	> 5	> 5	8.71
BOD5 mg/L	> 3	> 5	> 3	3.955
T.H mg/L	100 - 500	100-500	-	387.5
Cl^- mg/L	200	200 – 600	200	136.81
NO_3^- mg/L	0 – 45	0 – 40	25 –50	10.73
PO_4 mg/L	0.1	0.4	0.4	0.325



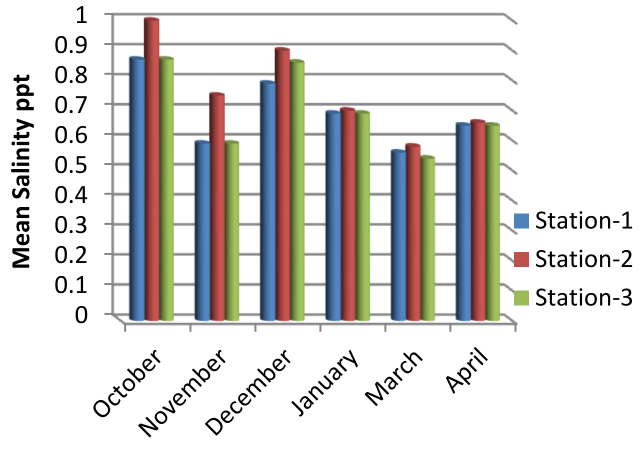
(Fig.2)Monthly changes in Air Temperture in three selected stations



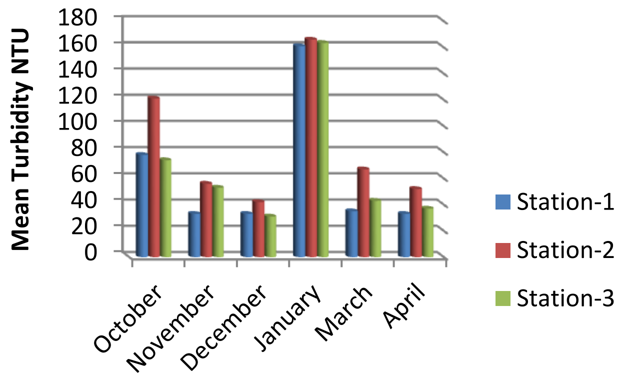
(Fig.4) Monthly changes in Hydrogen concentrated in three selected stations



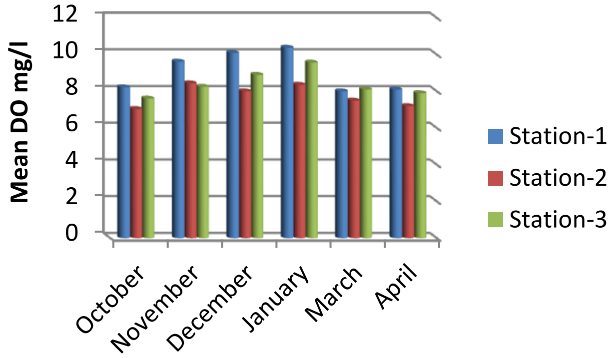
(Fig.5)Monthly changes in Electrical Conductivity in three selected stations



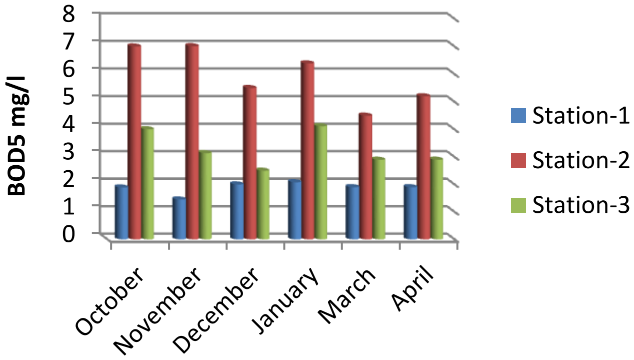
(Fig.6)Monthly changes in salinity concentrated in three selected stations



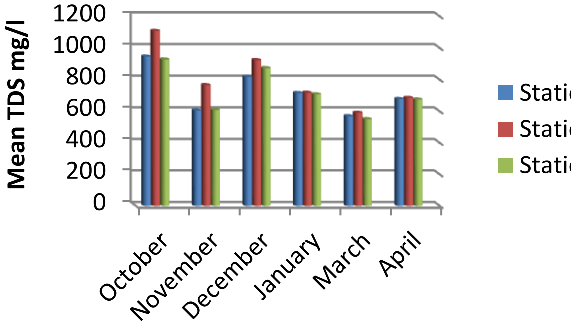
(Fig.7) Monthly changes in Turbidity in three selected stations



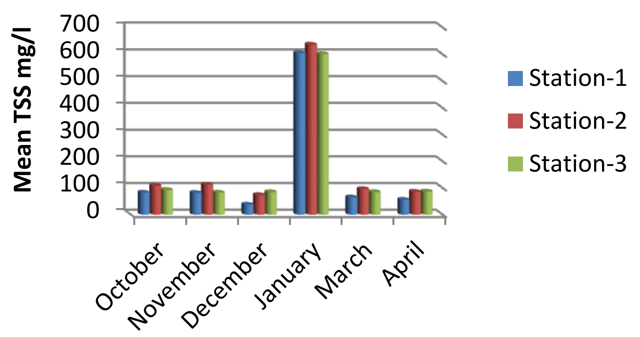
(Fig.8) Montly changes in Dissolved Oxygen in three selected stations



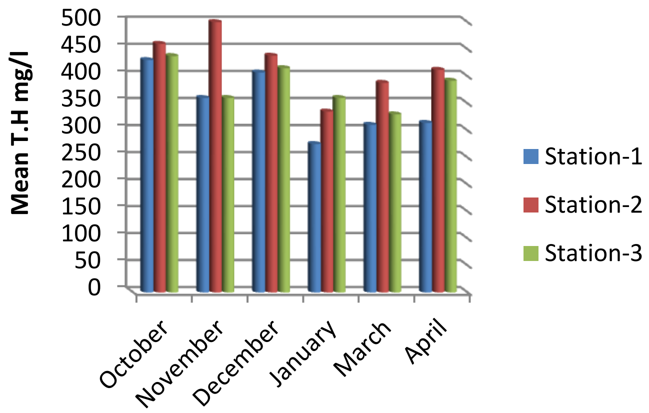
(Fig.9) Monthly changes in Biological oxygen demand in three selected stations



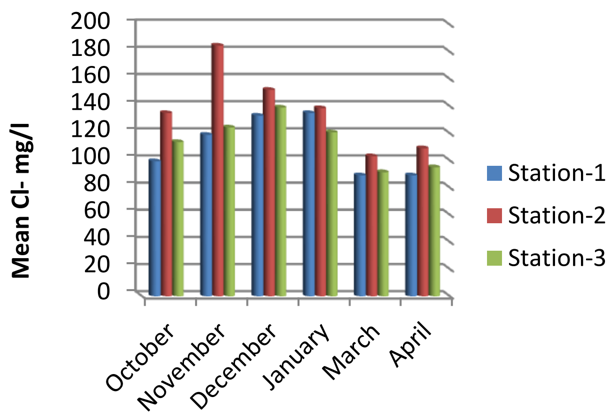
(Fig.10)Monthly changes in Total Dissolved solids in three selected stations



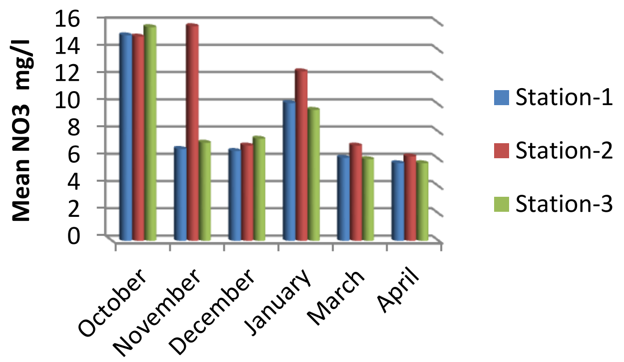
(Fig.11)Monthly changes in Total Suspended solids in three selected stations



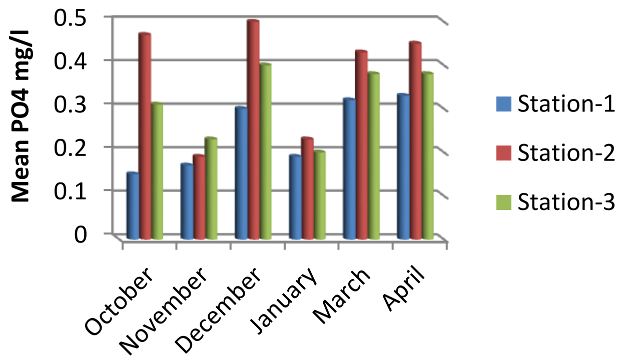
(Fig.12)Monthly changes in Total Hardness in three selected stations



(Fig.13)Monthly changes in Chloride in three selected stations



(Fig.14)Monthly changes in Nitrate concentrated in three selected stations



(Fig.15)Monthly changes in Phosphate concentrated in three selected stations

4. Discussion

Air and water temperature is an important factor in any aquatic environments affecting on biological processes, in this study it was ranged between 16 to 32 ◦C and 11 to 26 ◦C respectively. This result was similar to previous studies done by [11] [12].

The pH value of AL-Garraf River in study sites during of most studied period was alkaline side above 7, and this result agreed with [13], they reported that Iraqi inland water is regarded to be on the alkaline side of neutrality, reflecting geological formations of the area and the results are agree with the finding that recorded by [14] [15].

Electrical conductivity used as an indicator of water quality based on total dissolved salts [16]. The increase EC values at station two reflects the strong effect of domestic sewage effluent discharge at this area. Also, EC values recorded in the present work is coincided with findings of [17] [18].

The study also revealed monthly changes in salinity, with notable increase during summer months due to evaporation [19]. The presence of agricultural drainage systems namely, Kut, Al-Muafakiah and AL-Haay may contribute in rising salinity as well.

Water turbidity is caused by suspended matter such as clay, silt and planktons also turbidity degree of River water is an approximate measure of the intensity of the pollution [20]. This result was similar to previous studies done by [21] [22].

Oxygen content of water is one of the important factors, and it is very necessary for all living organisms [23].The study finding coincided with other authors [24] [25] [26] on Iraqi inland waters mainly Tigris. Low concentration of DO recorded from station-2 may relate to organic wastes discharged from Al-Haay City. Generally, the DO at most stations of canal water was within normal guideline values cited by [27] for the protection of aquatic life.

The biological oxygen demand is defined as the quantity of DO which is able to oxidize the organic components in the water with the assistance of microorganisms under defined experimental conditions [28] . Generally, results indicate increasing levels of BOD, in particular at station-2 during the November and October , this may be due to decomposition of organic matters run directly to the river with domestic sewage. These results were slightly higher than that reported by [29] [30] at the same river.

Values of total hardness in the selected stations exceeded 490 mg/L as $CaCO3$. This indicates that waters are very hard according to [31]. Increase in hardness values was found to coincide with rise in salinity [32] [33].The results of total hardness are agreed with those of [34] [35].

Chloride is a natural substance present in all portable water as well as sewage effluents as metallic salt. Generally high concentration of chloride indicates to organic pollution in the water [36]. This result was similar to previous studies done by [37] [38].

Total dissolved solids (TDS) is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water [39]. These results were slightly lower than that reported by [40] [41] at the same river.

Total suspended solids are considered to be one of the major pollutants that contributes to the deterioration of water quality, contributing to higher costs for water treatment, decreases in fish resources, and the general aesthetics of the water [42], TSS values recorded in the present work is coincided with findings of [43] [44].

Nitrate is the stable form of combined nitrogen and it is an important factor which might limit growth of phytoplankton [45]. The results of nitrate are agreed with those of [46] [47].

Phosphorus is essential to the growth of algae and other biological organisms. The reactive phosphate concentration in studied river was ranged between 0.1 to 0.5 mg/l. The high concentration of phosphate may be due to sewage water effluent and fertilizer application in surrounding agricultural area. This result was close to that reported by [48] [49].

5- Conclusion

1- The waste of factories, urban run-off, city sewage and the agricultural activities were affecting the physicochemical characteristics of Al-Garraf River.

2- The results revealed that water parameters were most within the Iraqi standards, and WHO standards for the raw water.

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